

ESTIMATES OF UNREPORTED LOSS RESULTING FROM A SPECIAL DEER HUNT ON CRAB ORCHARD NATIONAL WILDLIFE REFUGE

by

J. W. HARDIN

Cooperative Wildlife Research Laboratory, Southern Illinois University
Carbondale, IL 62901

J. L. ROSEBERRY

Cooperative Wildlife Research Laboratory, Southern Illinois University
Carbondale, IL 62901

ABSTRACT

A systematic search of 5,200 acres on Crab Orchard National Wildlife Refuge was conducted to assess unreported losses of deer following two 3-day special deer hunts in 1974. Of 1,141 deer harvested from the Refuge, 334 (29 percent) were removed from the study areas. The search revealed that 67 deer (20.0 percent loss) were unretrieved by hunters on these areas, compared to an estimate of 32 percent loss as determined from responses by successful hunters to a post-hunt questionnaire. Inconsistencies between the sex-age composition of harvested deer and those left in the field suggested that some intentional abandonment may have occurred.

INTRODUCTION

To better evaluate the impact of hunting on a population of deer, the wildlife manager should be aware of the magnitude and composition of unreported loss resulting from accidental crippling and intentional wastage. Assessments of such loss have been variously characterized as negligible, low, or not serious (Krefting et al. 1955, Sanderson and Speaker 1954, Schofield 1960), to considerable or fairly large (Sanders 1939, Strode 1954). Others have assumed them to be from 10 to 15 percent (Loveless 1959, McCaffery et al. 1971). Quantitative estimates, based on field studies have generally ranged from about 15 to 25 percent of the legal harvest during any-deer seasons (Downing 1971, Julander and Robinette 1950, Teer et al. 1965, Weeks et al. 1971), but considerably higher during buck seasons (Costley 1948, DeBoer 1957). Harlow and Jones (1965) assumed that illegal activities and crippling losses in Florida equaled or exceeded the number removed legally.

The purpose of our study was to determine the number and sex-age composition of white-tailed deer (*Odocoileus virginianus borealis*) unretrieved during a special hunt on Crab Orchard National Wildlife Refuge (CONWR). We appreciate the assistance of graduate students of the Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale (CWRL), especially that of R. Fernald, M. Jones, and R. Marshalla. We also acknowledge the assistance of CONWR staff. This paper is a contribution from Project No. 15: Big Game Investigations, CWRL.

STUDY AREA AND HUNT MECHANICS

Crab Orchard National Wildlife Refuge, a 43,000-acre area situated mainly in Williamson County, Illinois, is managed primarily for Canada Geese (*Branta canadensis*). The western part of the Refuge is open to public use, including hunting; the eastern 18,000 acres, bisected by Crab Orchard Lake, is a fenced inviolate area (Figure 1). Habitat and land use have been described by Autry (1967) and Hawkins and Klimstra (1970).

To reduce the number of deer on the Refuge, portions of the inviolate area were open to hunting during the two 3-day halves of Illinois' 1974 split deer season. The Refuge was also hunted in 1966 and 1973. Approximately 10,700 acres south of Crab Orchard Lake were hunted during 15-17 November, and 5,100 acres north of the Lake were hunted during 13-15 December (Figure 1). An additional 800-acre tract around a Federal penitentiary was hunted by prison officials but was not included in our study.

Any Illinois resident having a valid Williamson County permit could apply for a Refuge permit. Names were drawn randomly until daily quotas were filled (around 400 and 300 per day during the first and second seasons, respectively). Hunting hours were from 0630 to 1600 each day. Hunters could harvest deer of any sex and age with shotgun and rifled slug, or muzzle loading rifles by stalking, driving, or still hunting. All successful hunters were required to report to a check station where the sex, age, antler characteristics, and weight of their deer were recorded. Hunters were asked to estimate the number of deer they shot but did not retrieve. They were then asked to designate their

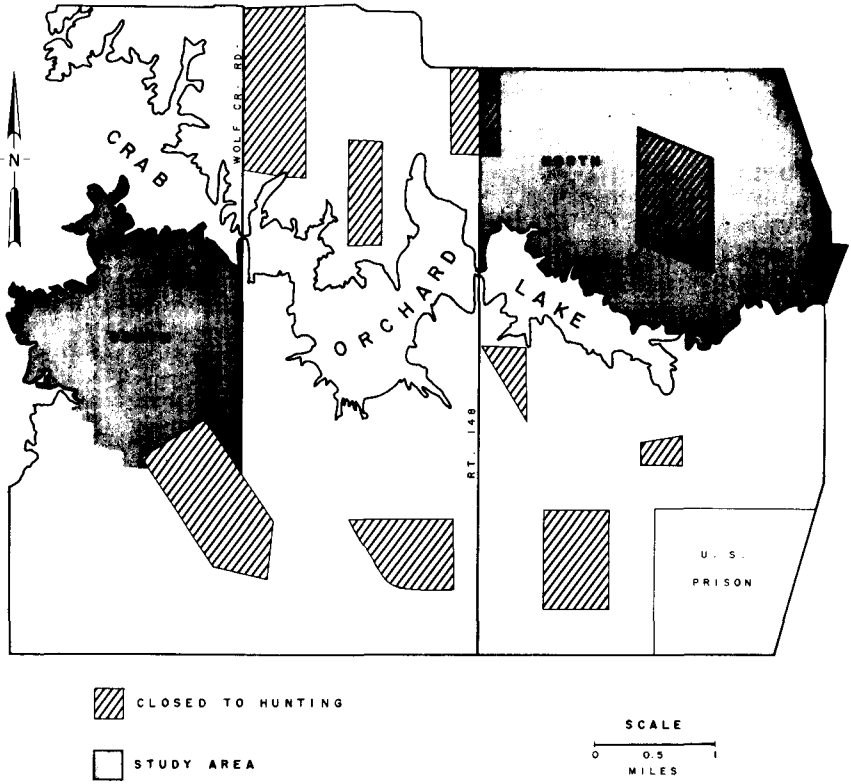


Figure 1. Map of the inviolate portion of Crab Orchard National Wildlife Refuge, Williamson County, Illinois, where a special deer hunt was conducted during the two 3-day Illinois deer seasons.

hunting location on aerial photographs of the Refuge. Unsuccessful hunters were requested to report the number of deer crippled, however few complied.

RESEARCH METHODS

Two study areas were established for the purpose of determining the amount and composition of the unretrieved loss. One 1,700-acre study area south of Crab Orchard Lake comprised 16 percent of the total acreage hunted during the first season. The second area was 3,500 acres in size, but included one 446-acre area which was closed to hunting. The hunted portion of this second study area represented 60 percent of the acreage hunted during the second season (Figure 1).

After allowing sufficient time for wounded deer to die (minimum of 17 days), the two study areas were systematically searched with the objective of finding all hunt-related mortalities. To cover the south side, 340 man-hours were expended during 4 December to 4 January; 960 man-hours were required during 6 January to 5 February to search the north side. Crews of four to nine individuals, aligned parallel and spaced at varying distances, depending on the amount and type of cover, systematically walked each area. Spacing was such that any deer positioned between searchers could be seen. Locations of cripples, sex, age, and location of the wound were recorded, and indications of unusual or illegal activity were noted.

RESULTS AND DISCUSSION

The 1974 special hunt on CONWR produced a legal harvest of 1,141 deer. Eight hundred of these animals were taken from the south side of the Refuge during the first 3-day hunt (an additional 25 came from the Prison), and 316 were harvested from the north side during the second 3-day season. Twenty-nine percent of the total harvest (excluding the Prison) came from our study areas (160 from the south and 174 from the north). In relation to their respective sides, the south study area represented 16 percent of the acreage and contributed 20 percent of the harvest, compared to 60 and 55 percent, respectively, for the north study area that was hunted.

The total harvest consisted of 39 percent yearling and adult males, 34 percent yearling and adult females, and 27 percent fawns. Sex-age ratios on the two study areas were comparable to the harvests on their respective sides, except that the south study area overrepresented adult males and underrepresented fawns.

Number of dead deer left in the field

Totals of 24 and 40 hunt-related mortalities were found during the post-hunt searches on the south and north study areas, respectively (Table 1). Refuge personnel retrieved an additional 15 deer from the south side, 3 of which were believed removed from our study area. The total of 67 deer unretrieved by hunters represents 20.0 percent of the legal harvest on the two study areas. Some dead deer may have been missed in flooded areas or because of consumption by scavengers, but our search was conservatively estimated to have been from 85 to 95 percent accurate. The lower figure would result in a revised estimate of 23.7 percent of the legal harvest being unretrieved. Rates of 16.9 and 23.0 percent for unretrieval on the south and north study areas, respectively, were not significantly different (X^2 in a 2×2 contingency table = 1.34, 1 df, $P > 0.20$). In other words, it could not be inferred from our data that a difference existed between the two sides of the Refuge with respect to the ratio of retrieved to unretrieved deer. However, our samples were relatively large (especially on the north side), hence the probability of the observed difference being real may be somewhat greater than the chi square test indicated. If the observed rates are used as literal estimates of the two sides, the projected loss becomes 18.6 percent ($0.169 \times 800 + 0.230 \times 316 / 1116$).

Our estimate of 19-24 percent unretrieved loss following the Crab Orchard hunt is similar to several other estimates from any-deer seasons of both white-tailed and mule deer (Downing 1971, Julander and Robinette 1950, Weeks et al. 1974). In contrast to this agreement, widely divergent assessments of unretrieved losses have been reported from other studies. Some of this variation probably reflects different research techniques but some is apparently due to other variables. A loss of 31 percent was estimated following the first controlled hunt on Crab Orchard in 1966 (Autry 1967) when hunters were not allowed to move more than 50 yards from designated stands. In contrast, only about 7 percent of the harvest was unretrieved during a unique hunt on the Sandhill Refuge, Wisconsin, in which the entire herd was removed during a 44-day period (Creed and Kubisiak 1973). As would be expected, losses during buck seasons are generally higher than during any-deer seasons. Costley (1948) estimated losses of 72 and 33 percent of the reported harvest during bucks-only and any-deer seasons, respectively, in Utah. Krefting (1964) reported losses of 108 percent during a 1962 buck season in Jackson County, Wisconsin, compared to 59 percent in the same area during the 1963 antlerless season. Other estimates of crippling and illegal loss following buck seasons have ranged from 23 percent during a mule deer hunt on Fort Stanton, New Mexico (Wood et al. 1970), to 175 percent during open seasons in Wisconsin (DeBoer 1957). Swank (1958) stated that between 15 and 50 percent of the deer bagged were unretrieved, depending on terrain, cover, type of hunt, and hunter ability. Weeks et al. (1974) found that wounding losses increased as the animals became more wary, and as hunter success decreased. Several authors (Sanderson and Speaker 1954, Schofield 1960, Severinghaus and Cheatum 1956) reported that high hunter density probably reduced such losses by increasing the incidence of salvaging dead or crippled deer by other hunters.

Hunter success was estimated at 69 percent during the first season on the south side and 46 percent during the second season on the north side (Unpubl. data, CONWR). If these rates were representative of our study areas, then an estimated 232 hunters utilized the south study area during the 3-day period (1 per 22 acres per day) and 378 hunted on the north study area (1 per 24 acres per day). Over the entire hunted portion of the Refuge, daily hunter density averaged 1 per 27 acres on the south side and 1 per 22 acres on the north side.

Hunter surveys or questionnaires are often used to assess unretrieved losses. Estimates in the range of 20-30 percent have been reported by Gladfelter (1973) in Iowa, Krefting (1964) in Minnesota, and Dechert (1967) in Kentucky. Hunter surveys may be positively biased because they do not take

salvaging into account (Schofield 1960) but negatively biased because they generally consider only cripples and not deliberately abandoned deer. Wood et al. (1970) estimated actual losses during a New Mexico mule deer hunt to be about 25 percent higher than indicated by check station data. Downing (personal communication), however, believed that hunters may overestimate the number of animals they hit. He used dogs to trail more than 100 deer reported hit by hunters but sign confirmed that only 70 had actually been wounded.

Our data also suggest an overestimation of crippling loss based on hunter interviews. During the 1974 Crab Orchard hunt, 41 (25.6 percent) of the successful hunters on the south study area reported crippling 60 deer or 37.5 percent of the legal harvest. On the north study area, 44 hunters (25.3 percent of those successful) reported crippling 48 deer or 27.6 percent of the recorded harvest. The combined estimate of 32.3 percent, which is undoubtedly low because most unsuccessful hunters were not interviewed, is still higher than the 19-24 percent estimated from the field survey. During the 1966 Crab Orchard harvest, successful and unsuccessful hunters reported a loss of 35 percent compared to 31 percent estimated from field searches (Autry 1967, Roseberry et al. 1969). The closer agreement of these data as compared to those from 1974 may reflect less salvaging in 1966 due to restricted hunter movement.

Differences in sex and age of retrieved and unretrieved deer

The sex-age composition of the legal and unretrieved kill on both study areas is shown in Table 1. Adult males comprised about 30 percent of the total harvest but only 12.5 percent of the deer left in the field ($Z=2.84$, $P<0.01$); the difference was evident on both study areas. In contrast, only about 19 percent of the legal harvest was adult females yet this group made up over 34 percent of the unretrieved sample ($Z=2.78$, $P<0.01$). This differential was more pronounced on the north than on the south side. A significantly higher proportion of female fawns were also left in the field than were checked in on the south side ($Z=2.86$, $P<0.01$), but the combined data showed no significant difference between the ratio of retrieved to unretrieved animals among yearling males, yearling females, and fawns (Table 1).

Evidence of a higher retrieval rate of adult bucks than other sex-age groups has also been noted for mule deer by Julander and Robinette (1950) during any-sex seasons. Downing (1971), however, found that bucks were lost at more than twice the rate of antlerless deer during 10 years of controlled hunts in a 746-acre enclosure in Georgia. Hoekstra (1971) noted a similar trend during controlled hunts on the Crane Naval Ammunition Depot in Indiana. Downing (1971) may have explained these apparently conflicting findings when he stated that crippling and abandonment have different effects on sex and age composition of lost deer. He suggested that fawns may be less susceptible to crippling because they are more likely to be killed instantly but more susceptible to abandonment because of their small size. Conceivable, too, adult males, because of their greater size and strength, may be harder to kill instantly and thus more likely to be crippled and escape. Hoekstra (1971) speculated that adult males may also inspire longer shots, thus increasing their likelihood of crippling. Intentional abandonment, on the other hand, probably involves adult bucks to a lesser extent than antlerless deer. Also, it is possible that the salvage rate is higher for antlered than for antlerless deer.

There was evidence of some deliberate waste during the Crab Orchard hunt. One fawn had been hidden in a brush pile, three deer (two females and a yearling male) had been field dressed and three adult males had been decapitated and their carcasses left in the field. At least six more unretrieved deer (three fawns and three adult females) had sustained what appeared to have been instantly fatal wounds.

According to our post-hunt survey, 24.9 percent of the hunters actively sought trophies while a non-exclusive 44.6 percent stated that sex and age of their kill was important to them. Of the former group, there was no significant difference in the sex and age of deer that were harvested ($X^2=3.84$, 1 df, $P>0.05$), than those taken by non-trophy hunters; however, of those hunters that indicated that sex and age made a difference, significantly more took adult males ($X^2=10.94$, 1 df, $P<0.001$) and fewer adult and fawn females ($X^2=7.52$, 1 df, $P<0.01$; $X^2=4.25$, 1 df, $P<0.05$, respectively). The relationship, if any, between intentional wastage and the degree of selectivity among hunters is not known. It is generally thought (or at least hoped) that most selective hunters defer shooting until a desirable target presents itself. Apparently, however, a small percentage of hunters on Crab Orchard continued to hunt after killing and abandoning deer. It is not known whether the high deer density (successful hunters saw an average of 45.4 and 16.3 deer per day on the south and north sides, respectively), or the much publicized need to reduce herd size contributed to this behavior. Obvious abandonment was indicated for only 1 of the 24 deer found on the south study area (4 percent), but was suggested for 12 of the 40 unretrieved deer on the north study area (30 percent). Reasons for this

Table 1. Legal harvest and crippling loss resulting from a special hunt of white-tailed deer on two study areas within Crab Orchard National Wildlife Refuge in 1974.

Sex-age Class	South Study Area		North Study Area		Total Study Area	
	Legal Harvest	Crippled ¹ Deer	Legal Harvest	Crippled Deer	Legal Harvest	Crippled ¹ Deer
Adult males	62 (38.7%)	4 (16.7%)	40 (23.0%)	4 (10.0%)	102 (30.5%)	8 (12.5%)
Yearling males	18 (11.2%)	2 (8.3%)	28 (16.1%)	6 (15.0%)	46 (13.8%)	8 (12.5%)
Fawn males	19 (11.9%)	2 (8.3%)	37 (21.2%)	4 (10.0%)	56 (16.8%)	6 (9.4%)
Adult females	36 (22.5%)	8 (33.3%)	29 (16.7%)	14 (35.0%)	65 (19.4%)	22 (34.4%)
Yearling females	14 (8.8%)	2 (8.3%)	17 (9.8%)	4 (10.0%)	31 (9.3%)	6 (9.4%)
Fawn females	11 (6.9%)	6 (25.0%)	23 (13.2%)	7 (17.5%)	34 (10.2%)	13 (20.3%)
Fawn unknown	0	0	0	1 (2.5%)	0	1 (1.5%)
Totals	160 (100.0%)	24 (99.9%)	174 (100.0%)	40 (100.0%)	334 (100.0%)	64 (100.0%)

¹ Three crippled deer removed from the south area by Refuge personnel during the hunt are not included.

difference are unclear, but incidence of other violations were also greater during the second season (personal communication, Refuge officials). It should be noted that uneven retrieval rates among sex-age groups occurred on the south as well as the north study area, suggesting that some selected abandonment occurred there also.

Reduction of the deer herd to ease competition with geese was a major stated objective of the 1966, 1973, and 1974 hunts on CONWR; and, since it seems likely that more special hunts will be held in the future, it is important to carefully assess the results of past hunts. Response of the deer population to periodic or annual harvests is dependent on the size and composition of both the legal harvest and the unretrieved kill, which in turn apparently vary with hunting methods and intensity (Roseberry and Klimstra 1974, this paper). Therefore, it is essential that harvest strategies be carefully chosen to meet specific objectives, and that past results be continually evaluated to insure that future controlled hunts result in the desired impact on the deer population.

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THE DYNAMIC ASPECTS OF DEER POPULATIONS UTILIZING A REFUGE¹

by

KENT E. KAMMERMEYER

School of Forest Resources, University of Georgia
Athens 30602

R. LARRY MARCHINTON

School of Forest Resources, University of Georgia
Athens 30602

ABSTRACT

The impact of refuges on white-tailed deer (*Odocoileus virginianus*) movements and population dynamics, although often discussed, has never been clearly documented in the Southeast. This study used radio telemetry, modified Lincoln Index censusing, sex ratio counts, kill data and observations of 40 marked deer from March 1973 through November 1974 to analyze movements between Berry College Refuge and contiguous hunted areas in northwestern Georgia. Three major patterns of movement seemed apparent: (1) relatively sedentary movement patterns of resident refuge deer, (2) dispersal of 1.5 and 2.5-year-old bucks from the refuge coincident with the onset of rut, and (3) migration of a large contingent of deer (mainly does) onto the refuge coincident with the opening of hunting season. Bucks dispersing from the refuge sustained considerable mortality from hunting. The concurrent influx of deer onto the refuge, however, nearly doubled the population ($P < 0.05$). These migrants remained on the refuge (where an abundant food supply was available) until late winter when they gradually returned to their summer ranges. Implications of our results are discussed regarding the concept of refuges in deer management, both as useful tools in the case of over-harvested herds and as difficult problems in situations where overpopulation exists.

Leopold (1947:195) defines a refuge as, "An area closed to hunting in order that its excess population may flow out and restock surrounding areas." The refuge concept as a deer management tool generally fell into disrepute in the 1950's as a result of studies showing deer to be very sedentary. More recent evidence has indicated that deer are more mobile than was previously believed. Hawkins et al. (1971) found heavy dispersal of bucks from Crab Orchard National Wildlife Refuge in Illinois. Migrations or large seasonal shifts of home range are not commonly reported for southern deer (Hahn and Taylor 1950, Thomas et al. 1964, Michael 1965, Siglin 1965, Marchinton and Jeter 1966). Several years ago, however, wildlife biologists at Berry College began to suspect that hunted deer were moving into a refuge in the fall, resulting in low hunter success and inadequate harvests on surrounding land open to deer hunting. Our study attempts to evaluate the interrelationships of refuges and hunted areas in the ecology of a deer herd. Up to the present time, migratory movements of large numbers of white-tailed deer have not been documented in the Southeast, and the effects of a refuge on deer movement have not been analyzed in a southeastern habitat.

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